Space Weather Technical Forecast

Issued on Tuesday, 25 June 2024 at 13:18 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

GOES16/18 satellite data feeds are currently experiencing a data gap since approximately 24/2120 UTC, as a result our Alerts and Warnings service may experience delays or contain incomplete data.

Space Weather Forecast Headline: Further M-class flares likely.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Moderate, with low M-class flares in the past 24 hour, predominately from AR3713 from over the southwest limb. This has now rotated off the disc, with the main activity switching to AR3623 on the southeast disc. This is a wide region, comprised of a string of small spots, including a weak delta configuration, but has remained relatively inactive during the last 24 hours. The other regions are all simple unipolar spots.

A large filament eruption off the west disc was observed around 25/0200 UTC, and a CME has now been observed on STEREO A imagery, as an asymmetric partial halo. This may have an Earth-directed component, however preliminary analysis suggests this is a relatively slow CME, with arrival most likely day 4 (28 Jun) or just beyond this period. Analysis is ongoing.

Solar Wind / Geomagnetic Activity: Background slow wind conditions were observed but with a very weak transient feature observed from 24/1720 UTC. Solar wind speeds observed by ACE at L1, were at Background, below 350 km/s. Density was below average. Interplanetary Magnetic Field, Bt, was weak at around 3-4nT, but saw an increase to average around 5-6nT following the transient arrival. North-south component, Bz, was weak, varying between +6 and -6 nT, but favoured a negative (southward) directed from 25/0030 UTC. Phi angle was predominantly negative (towards the Sun). Geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux observed by GOES18 remained at background levels with no solar radiation storms occurring although it showed a slight increase towards the end of the period. High energy electron flux (greater than 2MeV) observed by GOES16 was at background. The 24-hour fluence remained below Active, reaching 1.45e6 integrated pfu by 25/0000 UTC. Due to the data gap this is based upon the best data at time of issue.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a chance of Further M-flares, with a slight chance of isolated X-class flares. These most likely from either the recently departed sunspots in the far west in the near term, or AR3623 in the southeast.

Solar Wind / Geomagnetic Activity: There are two CMEs of note. A weak enhancement is possible late day 3 or early day 4 from a very glancing interaction with a filament eruption CME from 23 Jun. A further enhancement is possible on 29 Jun from the arrival of any CME from the filament disruption on 25 Jun. This is low confidence however. Otherwise solar winds are expected to remain near background with no notable enhancements forecast. Geomagnetic activity is forecast to be mainly Quiet, with only isolated Unsettled intervals. Perhaps the chance of Active to G1 Minor Storm intervals, mainly with the second of the two CMEs on day 4 (28

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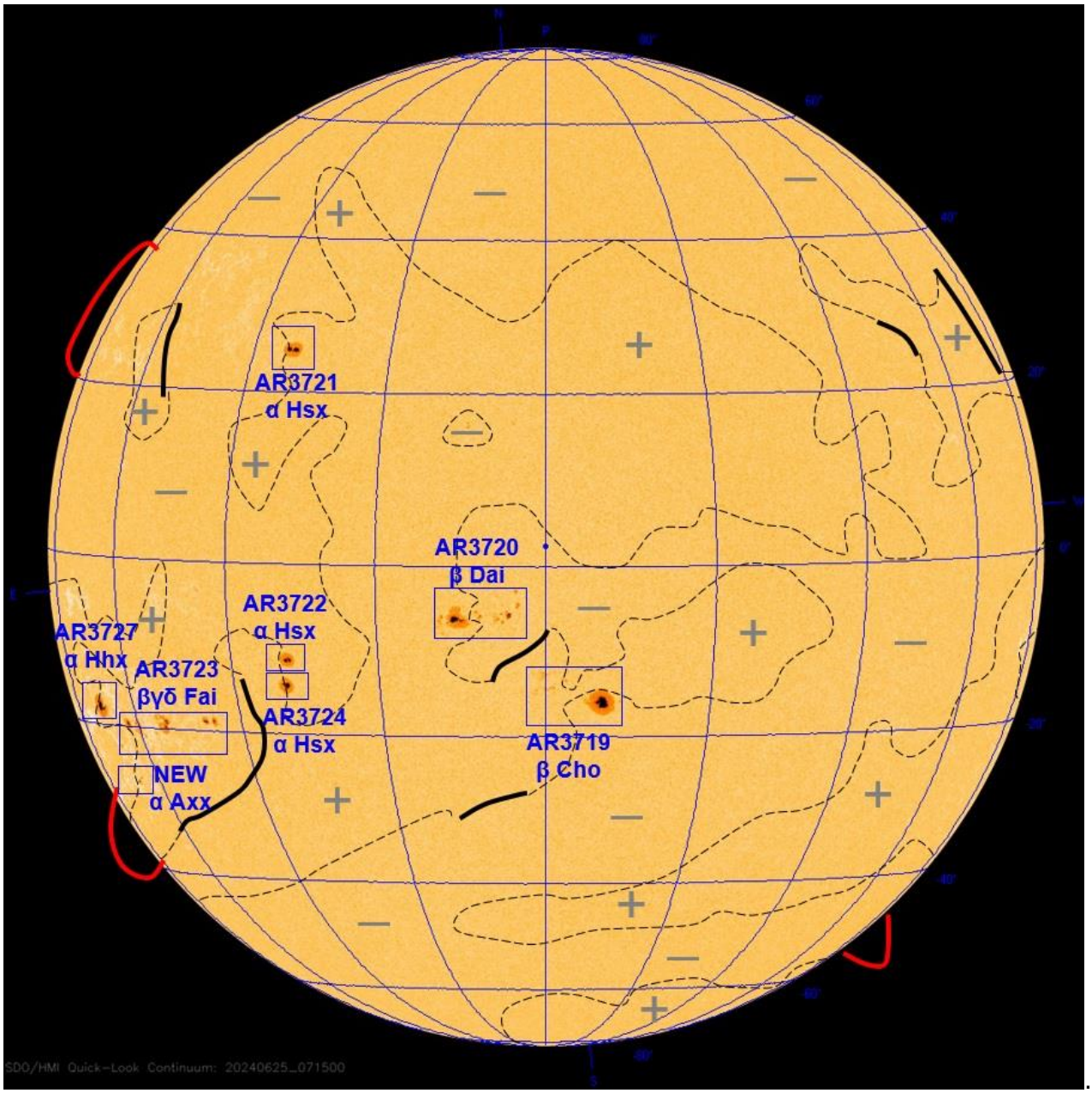
Jun).

Energetic Particles / Solar Radiation: High energy proton flux is expected to remain at background, with a slight and declining chance of exceeding the S1/Minor Storm threshold should any notable flares occur from any of the three large sunspots now around the western limb. High energy electron flux is forecast to be at background. The associated 24-hour fluence is expected to remain well below the Active threshold.

Figure 1. Solar Analysis Valid *.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are two CME's of note. The first, is associated with a filament eruption on 23 Jun and is expected to miss just behind and south of Earth, however a weak glancing influence cannot be completely ruled out late on day 3 (27 Jun) or early day 4 (28 Jun). The second is due to the large filament disruption off the west disc early on 25 Jun, resulting in a broad asymmetric partial halo as seen from STEREO A. This has yet to be fully analysed, however given early estimates, an arrival is unlikely until at least day 4 (28 Jun). Filament eruption CMEs can be rather dense on arrival, so geomagnetic storming will remains possible despite the low speed, if the CME is Earth-directed.

Aside from any CME arrival, solar winds are expected to remain indicative of a slow background flow with no coronal holes of note currently on the Earth-facing disc. Solar wind speeds are likely to persist at background with geomagnetic activity forecast to be mainly Quiet, with a chance of isolated Unsettled intervals. The first CME is unlikely to give more than Active intervals, even if an impact is observed. The second CME has the potential to give G1-G2 Minor/Moderate Storms later day 4 (28 Jun).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	5	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
24/0054	Nil	Filament	SE	436 km/s	Missing	Small chance glance 27 Jun
*	Partial (from St A)	Filament	W	493 km/s	Late 28 Jun	Preliminary analysis. Further assessment required.

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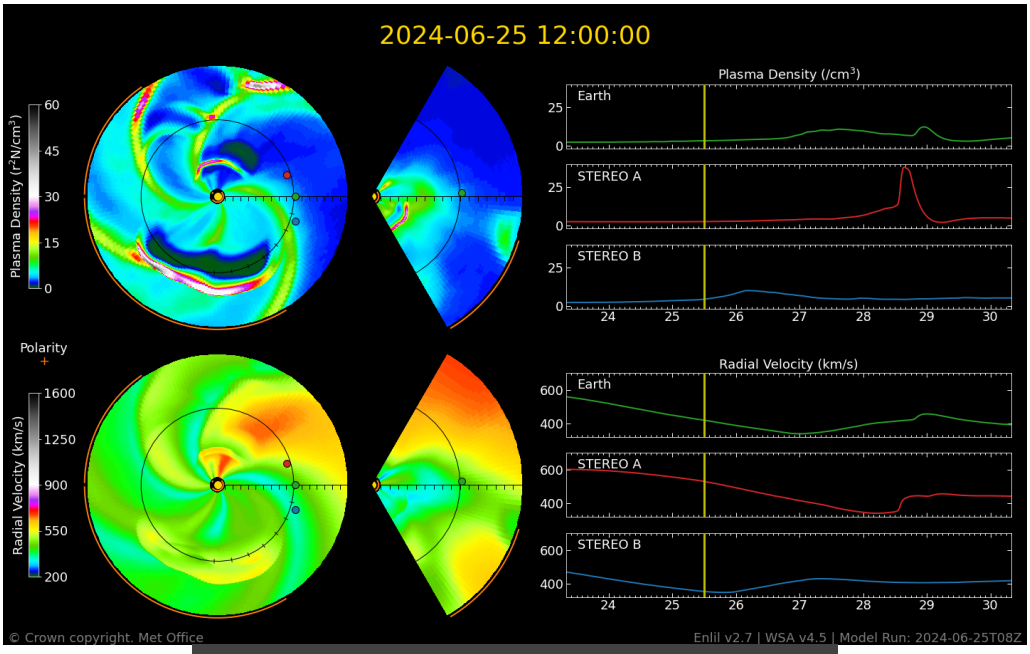
Figure 2: Enlil and Ensemble



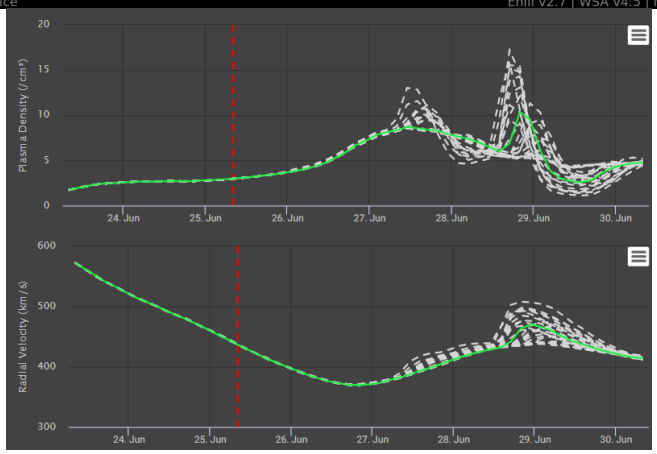
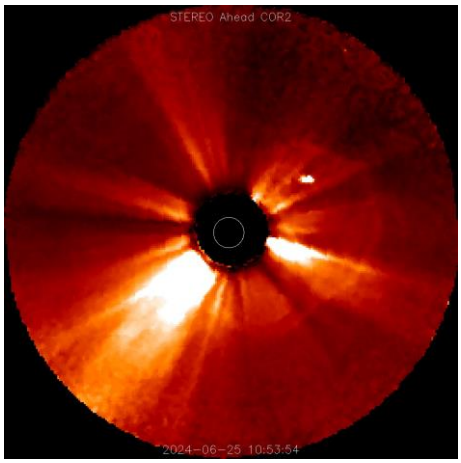


Figure 3: STEREO A Cor2 showing partial halo



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Radio Blackouts - X-Ray Flares:

Moderate to Low activity is expected with a chance of isolated M-class flares. AR3623 is the most notable of the eight regions currently on the solar disc, with a very slight chance of X-class flares. M-class, perhaps X-class flares also remain possible from the looping evident over the west limb, likely from AR3612/13, however this potential is now declining.

AR3623 is a wide region but small in terms of area, consisting of a string of small spots, including a central delta-configuration. The other regions on the disc are generally mature unipolar spots, with the only other exception being AR3620 in the centre disc. This region, however, is a small and mature bipolar region that is simplifying with the extent of the penumbra across its leader spots decreasing.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	60	60	60	60
Very Active	R3 to R5 X Class	No	10	10	10	10

Solar Radiation Storms - (High Energy Protons):

GOES-18 high energy protons were slightly above background levels before the data outage around 2120 UTC. This was due to a flare from AR3712 from just beyond the southwest limb on 24 Jun. Proton flux is forecast to gradually decline back to background with, only a slight chance of further enhancement. This risk declining a little as the regions that have recently moved of the west limb moving further on the far-side, while the majority of the current sunspots on the disc persist in the eastern hemisphere.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	10	5	5	5
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons Event (≥ 2MeV):

High energy electron flux, as observed by GOES-16, has been at background. With no notable sources of enhancement forecast, flux is expected to persist at this level.

Associated electron fluence is expected to persist well below the Active threshold (1e8 integrated pfu), with MOSWOC REFM output considered to be giving good guidance.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^{8}$	No	1	1	1	1
Very Active	≥ 2 MeV ≥ $1x10^{9}$	No	1	1	1	1

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